STRUCTURAL MEMBER SUPPORT AND POSITIONING SYSTEM AND METHOD OF MANUFACTURE THEREOF

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

This invention directs itself to construction systems utilized for properly locating structural members which span between laterally spaced supporting structures. In particular, this invention directs itself to a system wherein a mounting member is secured to a surface portion of a supporting structure. The mounting member is provided with a plurality of structural member receiving spaces. Still further, the present invention includes a mounting member formed by a longitudinally extended base plate having a plurality of double walled protuberances formed thereon and the method of manufacture thereof. A portion of the double walled protuberances are arranged in pairs of double walled protuberances disposed in opposing spaced parallel relationship to define a corresponding number of structural member receiving spaces therebetween. More in particular, this invention pertains to double walled protuberances that are formed with ribs or angularly directed flanges to stiffen the double walled protuberances.

PRIOR ART

Construction devices for positioning and securing structural members to supporting walls are well known in the art. The best prior art known to Applicant include U.S. Patents #6,672,014; #6,412,233; #5,884,448; #5,606,837; #5,412,920; #4,878,323; #4,704,829; #4,669,235; #4,637,195; #4,596,101; #4,490,956; #4,361,999; #4,246,736; #4,122,647; #4,080,771; #3,959,945; #3,421,270; #3,390,494; #3,289,362; and, #2,964,807.

In earlier systems having an inventor in common with an inventor of the instant invention, as disclosed in U.S. Patents #6,672,014 and #6,412,233, structural member receiving spaces are defined between vertically directed C-shaped channel members. The channel members are affixed to a base plate by a conventional means of fastening, such as welding. While the resulting mounting devices add considerable strength to the resulting building structure, their manufacture is not highly efficient.

In some prior art systems, such as that disclosed by U.S. Patents #4,080,771 and #4,669,235, there are provided truss aligning systems which become an integral part of the building structure when it is completed. In such systems, a flat metal member is provided which is mounted to the top plate of a building frame. The flat metal member has a plurality of pairs of upstanding flanges laterally spaced along the plate. Each of the pair of flanges are spaced

apart one from another by a distance corresponding to the thickness of a roof truss or other structural member. Each of the flanges is provided with a plurality of apertures through which fasteners can be driven to secure the structural member thereto.

SUMMARY OF THE INVENTION

A system for supporting and positioning structural members is provided. The system includes at least one mounting member secured to a surface portion of a supporting structure. The mounting member has a plurality of structural member receiving spaces formed thereon. The mounting member includes a longitudinally extended base plate having a plurality of spaced through openings formed therein. The base plate has a plurality of folded portions formed therein. Each folded portion defines a double walled protuberance extending from a surface of the base plate. At least a portion of the double walled protuberances are arranged in pairs disposed in opposing spaced parallel relationship to define a corresponding number of the receiving spaces between each respective pair.

From another perspective, the present invention provides a method of forming a mounting member for use in supporting and positioning structural members. The method includes the steps of providing a longitudinally extended base plate, and forming a plurality of through openings therein. The step of bending the base plate is also included. The base plate is bent to form a plurality of longitudinally spaced double walled protrusions therein. A space between respective pairs of the double walled protrusions defines a receiving space for receiving a structural member therein.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the present invention;

FIG. 2 is a cut-away elevation view of a double walled protrusion of the present invention;

FIG. 3 is a perspective view illustrating an application of the present invention;

FIG. 4 is a perspective view showing another application of the present invention;

FIG. 5 is a cut-away perspective view of a base plate of the present invention prior to the double walled protrusions being formed;

FIG. 6 is a cut-away elevation view of a double walled protrusion showing openings formed therein;

FIG. 7 is a cut-away perspective view of the present invention showing stiffening flanges;

FIG. 8 is a cut-away perspective view of the present invention showing another configuration of stiffening flanges; and,

FIG. 9 is a block diagram of the method of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. 1 through 4, there is shown structural member support and positioning system 200 for securing and properly locating structural members 20, 30 of a building during its construction. System 200 becomes a permanent part of a completed building, and facilitates the rapid setting of structural members such as roof trusses 20 or floor joists 30 between corresponding supporting structures, such as a pair of longitudinally extended laterally spaced building supporting walls 10 or steel beams supported by columns or walls, and provides improved strength of the resulting structure.

Referring more specifically to FIGS. 1, 2 and 3, there is shown structural member support and positioning system 200 wherein at least one mounting member 205 is mounted to a supporting structure, such as the substantially horizontal surface portion of a longitudinally extended laterally spaced building supporting wall 10. Multiple mounting members 205 may be serially joined one to another at the upper surface of a supporting structure, so that the mounting members can be supplied in standard lengths that can be easily handled by user's of system 200. It is contemplated that a substantially equal number of mounting members 205 would likewise be mounted to an opposing supporting structure across which the structural building members 20 span. In the example shown in FIG. 3, the structural building members are roof trusses having a lower truss member 22 and at least an upper truss member 24. Each mounting member 205 has a plurality of structural member receiving spaces 218 formed thereon, so that

the lower truss member of the roof truss 20 can be positioned to extend between a pair of spaced supporting walls 10, for example.

The mounting member 205 is secured to the header 12 that is supported by a plurality of studs 14 of a framed wall 10. The header 12 may be formed by one or more individual members, formed of wood, metal, laminated or composite materials, as permitted or required by local building codes, without departing from the spirit or scope of the inventive concepts disclosed herein. Each mounting member 205 is formed by a longitudinally extended base plate 210 having a plurality of through openings 212 formed therethrough. Each through opening 212 is a longitudinally directed slot formed through the base plate 210. The longitudinal extension of openings 212 is preferred to a slot extending transversely across the base plate 210, as transversely directed slots significantly reduce the resistance to bending of the base plate. Through openings 212 provide a passage for fasteners 16 to secure the base plate 210 to the header 12. Fasteners 16 may be screws, nails or bolts, as appropriate to the material of header 12 and local building codes. Base plate 210 is also provided with through openings 214 and 219 respectively formed in tabs 216 and 217, and through holes 215.

Each base plate 210 further has a plurality of folded portions 222 formed thereon that respectively define double walled protrusions 220. At least a portion of the double walled protrusions 220 are arranged in pairs. Each pair of double walled protrusions 220 are disposed in opposing spaced parallel relationship and between which is defined a respective one of the structural member receiving

spaces 218. Individual double walled protrusions 220 are located adjacent opposing ends of base plate 210. The folded portions 222 of the base plate 210 that form the double walled protrusions 220 provide a rigid vertically directed structure to provide improved lateral stability and torsion resistance to the support of corresponding structural members 20. As will be discussed hereinafter, the rigidity of the double walled protrusions 220 may be further increased by several different means. The folded portions 222 of base plate 210 also provide for the improved structural integrity of the mounting member 205 by increasing the rigidity of base plate 210 and insuring that the vertical orientation of the double walled protrusions 220 are maintained during shipment and storage.

Each mounting member 205 further includes individual folded portions 222 respectively formed on the base plate 210 to respectively define double walled protrusions 220 adjacent opposing longitudinal end portions thereof. At one longitudinal end portion of mounting member 205, a joining tab 216 extends. The joining tab 216 extends a distance substantially equal to a like dimension of the structural member receiving spaces 218. Two mounting members 205 are serially coupled together by overlapping the joining tab 216 of one mounting member 205 on the joining tab 216 of the other mounting member 205. A receiving space is thus formed between the double walled protrusions 220 adjacent to the overlapped tabs. Each of the overlapped joining tabs 216 have aligned through openings 214 respectively formed therein. By that arrangement, the mounting members 205 can be consecutively positioned on the header 12, one

following another, while maintaining the appropriate center-to-center distance between the structural member receiving spaces 218 across the all of the joined mounting members 205. The opposing longitudinal end of mounting member 205 is provided with an end tab 217 extending therefrom. End tab 217 has a bend line 217a formed therein. Bend line 217a is spaced from an adjacent double walled protrusions 220 by a distance substantially equal to a like dimension of the structural member receiving spaces 218. By that arrangement, an outer portion 217b of end tab 217 can be bent upwardly to define a structural member receiving space 217c between the outer portion 217b of end tab 217 and the adjacent double walled protrusions 220. The portion of end tab 217 that forms the structural member receiving space 217c has a through opening 214 formed therein. The outer portion 217b of end tab 217 has a plurality of through openings 219 formed therein that correspond in size, contour and location, subsequent to bending, to the through openings 234 of the double walled protrusions 220. It is within the scope of the instant invention that the mounting members may be formed with joining tabs 216 or end tabs 217 at both longitudinal ends thereof. Where three or more mounting members are to be serially joined, the outer portion 217b of end tab 217 may be cutoff at the bend line 217a in the user to form a tab portion that is equivalent to a joining tab 216. It is also within the scope of the instant invention that the mounting members may be formed with a joining tab 216 or an end tab 217 at one longitudinal end and a double walled protrusions 220 with no tab at the opposing end. It is also

within the scope of the instant invention that joining tabs 216 or end tabs 217 may be formed at both longitudinal ends of the mounting members 205.

Referring to FIG. 5 and FIG. 2, the configuration of a folded portion 222 is shown. During the manufacture of mounting member 205, the base plate 210 is bent at three longitudinally spaced locations to form each folded portion 222. The base plate 210 is bent substantially orthogonally at a first reference line 50a to form the bend 210a and bent at the reference line 50b back on itself with a 180° bend 210b. The third bend 210c, made at reference line 50c, is another substantially orthogonal bend to thereby form a double walled protrusion extending from a surface of the base plate 210. The opposing bends 210a and 210c combined with the 180° bend 210b form a protrusion that is very stiff and provides good supporting structural members. If mounting member 205 is formed on punch presses, it is likely that the openings 212, 214, 215 and openings 234 will likely be formed in the same operation, prior to the bending of base plate 210 to form the double walled protrusions 220. The openings 234 are formed by forming openings 234a in the portions of base plate 210 that will form wall 220a of protrusions 220 and corresponding openings 234b in the portions of base plate 210 that will form wall 220b of protrusions 220. When the folded portions 222 are formed, the openings 234a respectively align with the openings 234b to define through openings 234.

Each mounting member 205 has an overall longitudinal dimension that is selected to be a standard length suitable for the construction industry. The

longitudinal dimension of each mounting member 205 may be 8 ,12 or 16 feet, for example. The center-to-center distance between adjacent structural member receiving spaces 218 is also selected to be a standard utilized in the construction industry, such as 16 inches or 24 inches. Obviously, those dimensions can be other than those mentioned above without departing from the inventive concepts disclosed herein. The distance between the pairs of double walled protrusions 220 is equal to the thickness of the structural member intended to be positioned therebetween. The height dimension of the double walled protrusions 220 is selected to provide stable support of structural members 20, 30. An example of a dimension of the height of the double walled protrusions 220 that provides a stable base of support is a height dimension that is at least 25% of the height of the structural member being supported.

As is common in construction practice, such building structural members as roof trusses and floor joists are typically joined to supporting walls utilizing a fastening technique known as "toenailing" wherein a fastener is driven angularly through a side of the structural member to exit a bottom surface thereof for securement into the upper member of a supporting wall. Mounting members 205 support the use of the "toenailing" technique in that the base plate 210 of each mounting member 205 includes a plurality of openings 214 formed therethrough in coincidence with each structural member receiving space 218, 217c and joining tab 216 thereof. Of particular importance, each opening 214 is a longitudinally directed slotted opening. The longitudinal extension of the

opening 214 facilitates toenailing at a wide range of elevation angles without having a deleterious effect on the rigidity of base plate 210, such as would occur if the openings extended transversely with respect to the longitudinal direction. Thus, between each pair of double walled protrusions 220 and in the tab 216, 217 there is disposed a longitudinally extended slotted opening 214 formed through the base plate 210 and through which a fastener exiting a bottom surface of a corresponding structural member can pass for entry into the header 12. Thus, as shown in FIGS. 3 and 4, a fastener 26 can be angularly passed through one of the openings 234 formed through the double walled protrusions 220 to secure a respective structural member 20, 30 to the header 12, and thereby secure the structural member 20, 30 to the mounting member 205.

Referring further to FIG. 4, there is shown structural member support and positioning system 200 utilized for positioning and securing floor joists 30 to a supporting wall 10, which may be a foundation wall of a building. In this application, J-bolts 32 which have been set in the supporting wall 10 provide the means for securing the mounting member 205 thereto. The J-bolts 32 pass through corresponding through openings 215 (shown in FIG. 1) wherein the threaded distal end thereof is engaged by a nut 34 which is tightened and holds the mounting member 205 in place. The floor joists 30 are positioned in the receiving spaces 218, between respective pairs of double walled protrusions 220, and secured thereat by fasteners 26, in the same manner as when roof trusses are secured thereto.

Prior to forming the double walled protrusions 220, one or more stiffening ribs 240 may be formed in portions of base plate 210 that will form the respective walls 220a and 220b of the double walled protrusions 220. While four ribs 240 (two ribs in each of the regions forming walls 220a and 220b) are shown, it should be understood that as few as one stiffening rib 240 may be formed in one of walls 220a and 220b. Where two ribs 240 are formed in each protrusion 220, one stiffening rib 240 may be formed in each of walls 220a and 220b and such may be offset from one another so as to be respectively located adjacent opposing longitudinal sides of base plate 210. Alternately, both ribs may be formed in one of the walls 220a and 220b. If ribs 240 are formed in each of the walls 220a and 220b, they may be formed in the same direction, as shown in FIG. 5, so that they face oppositely when the folded portions 222 are formed. The ribs 240 in walls 220a and 220b may be respectively formed in opposite directions (not shown), so that they become nested when the folded portions 222 are formed.

Another method of stiffening the double walled protrusions is shown in FIGS. 6, 7 and 8. After forming a double walled protrusion 220, at least one angled flange 232 is formed along a side thereof. In order to form a flange along a side of a double walled protrusion 220, a slot 231 extending between a respective bend reference line 230 and the corresponding side of the walls 220a and 220b is formed therein adjacent the bends 210a and 210c. Where two flanges are being formed, two slots 231 are respectively formed on opposing sides of

walls 220a and 220b. The flange portion may then be bent to extend angularly in a direction away from the adjacent receiving space 218. As an example, the flange 232 may be bent at an angle within the approximate range of 10° - 100° with respect to the remaining body of the protrusion 220. As shown in FIG. 7, each double walled protrusion 220 is formed with one angularly directed stiffening flange 232. While a representative pair of protrusions 220 are shown with stiffening flanges disposed on a corresponding sides thereof, the stiffening flanges may likewise be formed on respective opposing sides of the protrusions 220. A pair of stiffening flanges 232 may be formed on each double walled protrusion 220, as shown in FIG. 8. Each flange 232 being formed as previously described.

Thus, it can be seen that system 200 provides a means for increasing the efficiency of building construction, providing a quick and easy method for accurately setting structural members, such as roof trusses and floor joists with proper spacing therebetween. System 200 further adds stability to the structure during the construction phase and increases the structural integrity of the completed building. A portion of the efficiency achieved by system 200 is a result of the use of folded portions 222 of base plate 210 that form the double walled protrusions 220. The folding of the base plate 210 to form double walled vertically extending structures (with reference to a horizontally oriented base plate) are highly resistant to being deformed. That resistance is further increased by the formation of one or more ribs or angularly directed flanges therein. Thus,

when the mounting members 205 are utilized, the construction personnel need not take time out to realign the double walled protrusions 220, as such will be maintained in their proper vertical orientation. The provision of a joining tab 216 extending from an end portion of the mounting members 205 permits the mounting members 205 to be arranged consecutively while still maintaining the proper spacing between structural members mounted therein.

Referring to FIG. 9, a block diagram of the method of manufacturing system 200 is presented. The starting point for manufacturing mounting member 205 is the step 310 of providing the base plate material. The base plate material may be provided as preformed strips, strips in the required width and length. Alternately, the material can be provided in coil form and slit to the required width. The strips thus formed are cut to length either before or after further forming steps, depending on the tooling being utilized. The base plate material is next processed in a first set of forming steps 320, wherein the through openings 212, 214, 215, 219 and 234 are formed. Additionally, the openings 231 or the ribs 240 may be formed in step 320 if additional stiffening is being incorporated in mounting member 205. In a second set of forming steps 330, the folded portions 222 are formed, performing the bends 210a, 210b, and 210c. Steps 320 and 330 may be implemented on a series of presses sequentially carrying out the punching of through openings forming of bends in combinations of simultaneous and sequential operations on portions of the base plate material as it is displaced from one press to another. If the double walled protrusions 220 are to be

stiffened by angled flanges 232, then a step 340 is added to bend at least one edge portion of the folded portions 222 to respectively form the angled flanges 232.

Although this invention has been described in connection with specific forms and embodiments thereof, it will be appreciated that various modifications other than those discussed above my be resorted to without departing from the spirit or scope of the invention, for example, equivalent elements may be substituted for those specifically shown and described, certain features may be used independently of other features, and in certain cases, particular locations of elements may be reversed or interposed, all without departing from the spirit or scope of the invention as defined in the appended Claims.